light region of an organic EL device formed in Example 1 of the present invention.

Fig. 3 is a view of the transmission spectrum showing time dependence of a change in transmittance of a device processed by an oxygen plasma treatment in an example of the present invention.

Detailed Description of Embodiments

An organic EL device of the present invention is characterized in that on an anode and a light-emitting layer composed of an organic material provided on a substrate, a cathode is provided which has a structure in which a first cathode composed of a material having a work function of 3.0 eV or less and a second cathode composed of a material having a work function higher than that of the first cathode are sequentially stacked with each other from the light-emitting layer side, in which the total thickness of the first and the second cathodes is 100 angstroms or less, wherein light is emitted to the outside via at least the cathode.

As preferable modes of the organic EL device, the following are mentioned.

(1) In the organic EL device, the cathode side is sealed by a sealing layer composed of a transmissive material.

(2) In the organic EL device, the first cathode comprises Ca.

(3) In the organic EL device, the thickness y (angstrom) of the first cathode is such that $50 \leq y \leq 80$ holds.

(4) In the organic EL device, the thickness y (angstrom) of the first

cathode is such that $55 \leq y \leq 65$ holds.

(5) In the organic EL device, the second cathode comprises Al.

(6) In the organic EL device, the thickness z (angstrom) of the second cathode is such that $10 \leq z \leq 20$ holds.

(7) In the organic EL device, an organic material forming the light-emitting layer is a polymeric material.

In addition, a method for manufacturing an organic EL device of the present invention comprises the steps of forming an anode on a substrate; forming a light-emitting layer composed of an organic material above the anode; and forming a cathode above the light-emitting layer by laminating a first cathode composed of a material having a work function of 3.0 eV or less and a second cathode composed of a material having a work function higher than that of the first cathode from the light-emitting layer side so that the total thickness of the first and the second cathodes is 100 angstroms or less.

As preferable modes of the method for manufacturing the organic EL device, the following are mentioned.

(8) In the step of forming the anode in the method for manufacturing the organic EL device, after an electrode film is formed, an oxygen or an air plasma treatment is performed under conditions in which a current x and a time t are set such that 10 (mA) $\leq x \leq$ 15 (mA) and 5 (minute) $\leq t \leq$ 7 (minute) hold.

(9) In the step of forming the anode in the method for manufacturing the organic EL device, after an electrode film is formed, an oxygen or an air plasma treatment is performed under conditions in which a current x

and a time t are set such that 10 (mA) $\leq x \leq$ 12 (mA) and t = 5 (minutes) hold.

Hereinafter, the embodiments of the present invention will be described in detail with reference to drawings.

Fig. 1 is a cross-sectional view showing the structure of an organic EL device according to the present invention.

In the structure shown in Fig. 1, on a substrate 1, an anode 2, a hole injection/transport layer 3, a light-emitting layer 4 composed of an organic material, a first cathode layer 5 composed of a material having a work function of 3.0 eV or less, and a second cathode 6 (a cathode is formed of a stacked structure of the first and the second cathodes mentioned above) composed of a material having a work function higher than that of the first cathode are stacked . Next, the stacked structure described above is sealed by a first sealing layer 7, and a second insulating layer 8, and in addition, is sealed by a sealing substrate 9.

As the substrate 1, a transparent material, such as glass, or a reflective material may be used. When the transparent material is used, light can be emitted to the outside via at least the substrate 1.

As a material used for the anode, for example, ITO or IDIXO (manufactured by Idemitsu Kosan Co., Ltd.) may be mentioned as a transparent electrode material. The material mentioned above is deposited on a substrate so as to form an electrode by sputtering or the like. The transparent electrode thus formed is preferably processed by an oxygen plasma treatment or an air plasma treatment after the material